COURSES OF STUDY FOR MATHEMATICS HONOURS

(Approved by Academic Council)

DEPARTMENT OF MATHEMATICS

MARWARI COLLEGE, RANCHI

(AN AUTONOMOUS & CONSTITUENT UNIT OF RANCHI UNIVERSITY)

COLLEGE WITH POTENTIAL FOR EXCELLENCE SELECTED BY UGC

Website : marwari-college.org

Full Marks: 1600

Number of Semesters: 6

Number of Papers: 16

B. Sc. Hons. Part - I: 400 Marks (4 Papers)

B. Sc. Hons. Part - II: 400 Marks (4 Papers)

B. Sc. Hons. Part - III: 800 Marks (8 Papers)

Paper-wise distribution of marks in Mathematics Hons.

Academic year	Semester	Theory paper		Full marks			Pass marks	Duration
				MSE	ESE	TOTAL		
First Year	I	1	(A) Differential Calculus (B) Analytical Geometry of Two Dimensions	30	70	100	45	3 Hrs.
		2	(A) Integral calculus (B) Trigonometry	30	70	100	45	3 Hrs.
	II	3	(A) Real Analysis (B) Theory of Equations	30	70	100	45	3 Hrs.
		4	(A) Set Theory (B) Abstract Algebra	30	70	100	45	3 Hrs.
Second Year	III	5	(A) Elementary Number Theory (B) Analytic Geometry of Three Dimensions	30	70	100	45	3 Hrs.
		6	(A) Advance Abstract Algebra (B) Complex Analysis	30	70	100	45	3 Hrs.
	IV	7	(A) Vector Analysis (B) Mechanics	30	70	100	45	3 Hrs.
		8	(A) Advance Real Analysis (B) Differential Equation	30	70	100	45	3 Hrs.
Third Year	V	9	(A) Matrices (B) Linear Algebra	30	70	100	45	3 Hrs.
		10	(A) Advance Integral Calculus (B) Integral Transform	30	70	100	45	3 Hrs.
		11	(A) Linear Programming Problem (B) Probability & Statistics	30	70	100	45	3 Hrs.
		12	(A) Partial Differential Equation (B) Fluid Mechanics	30	70	100	45	3 Hrs.
	VI	13	(A) Special Function (B) Metric Space	30	70	100	45	3 Hrs.
		14	(A) Numerical Analysis (B) Discrete Mathematics	30	70	100	45	3 Hrs.
		15	Fundamentals of Computer and C Programming	30	70	100	45	3 Hrs.
		16	Practical		100	100	45	4 Hrs.

* *Approximate No. of lectures and Questions are given in the right side.*

B.Sc. Part – I (Mathematics Hons.)

Semester – I

PAPER – 1

Marks: 30 **(MSE) + 70 (ESE) = 100** **Time: 3 Hrs.** **Pass Marks: 45**

Instructions **:**

Answer seven questions selecting at least one from each group. Each question contains two parts : Part (a) & Part (b). Part (a) is of short answer type questions (e.g. definition, statement of a theorem and simple questions). It will be of 2 marks. Part (b) is of long answer type questions (e.g. theorems & its proof, problem(s) etc.). It will be of 8 marks.

[About 50% questions should be theoretical]

Group A: DIFFERENTIAL CALCULUS [L:30, Q:07]

- Successive differentiation, Leibnitz's theorem. [L:04; Q:01]
- Taylor's theorem for one variable, Maclaurin's expansion, Partial differentiation, Euler's theorem on Homogenous function of two Variables and of degree n. [L:06; Q:02]
- Tangents & Normal: Equation of Tangents at the origin, Angle of intersection of two curves, length of tangent, sub tangent, normal and sub Normal, Derivatives of Arc length in Cartesian coordinate, angle between radius vector and tangent at a point, Perpendicular from pole on tangents etc., Pedal equation of curve.

  [L:08,Q:01]
- Curvature : Radius of Curvature, Centre of curvature, circle of curvature, chord of curvature, radius of curvature at the origin.

  [L:04, Q: 01]
- Asymptotes. [L:03, Q: 01]
- Maxima and minima of functions of two variables. [L:05, Q: 01]

Group – B: ANALYTICAL GEOMETRY OF TWO DIMENSIONS [L : 20, Q : 05]

- Change of axes, matrix form of transformation, rigid body transformation. [L:03, Q:01]
- Conic Sections: Pair of straight lines, condition for the representation of a pair of straight line by general second degree equation, angle between two lines, equation of bisectors of pair of straight lines. [L:04, Q:01]
- Conditions for the general equation of second degree to represent Parabola, Ellipse and Hyperbola and reduction into standard forms, Equations of tangents and normal (using calculus method), Chord of contact, Pole and Polar, pair of tangents axes, Centre, Director circle in reference to general equation of conic. [L:09, Q:02]
- Polar coordinates and Polar equation of conic sections. [L:04, Q:01]

REFERENCES:

1. Differential Calculus - Das and Mukherjee/ Lalji Prasad
2. The Elements of Coordinate Geometry - S.L. Loney
3. A Text Book of Analytical Geometry of Two Dimensions - P.K. Jain and Khalil Ahmad.

***** *Approximate No. of lectures and Questions are given in the right side.*

4. Analytical geometry of two dimension – Jagdish Jha/ Lalji Prasad/ Chakravorty & Ghosh.
5. Calculus and Analytic Geometry - G.B. Thomas & S.Davis (John Wiley & Sons.)

***** *Approximate No. of lectures and Questions are given in the right side.*

B.Sc. Part – I (Mathematics Hons.)

Semester – I

PAPER – 2

Marks: 30 **(MSE) + 70 (ESE) = 100** **Time: 3 Hrs.** **Pass Marks: 45**

Instructions **:**

Answer seven questions selecting at least one from each group. Each question contains two parts : Part (a) & Part (b). Part (a) is of short answer type questions (e.g. definition, statement of a theorem and simple questions). It will be of 2 marks. Part (b) is of long answer type questions (e.g. theorems & its proof, problem(s) etc.). It will be of 8 marks.

[About 50% questions should be theoretical]

Group – A: INTEGRAL CALCULUS [L : 30, Q : 07]

- Integration of rational and irrational functions, Integration by transformation, by substitution, by parts, by partial fraction, Integration of transcendental function, Definite integration, General properties of definite integrals, Evaluation of definite integrals. [L:08, Q:02]
- Reduction formula. [L:03, Q:01]
- Special definite Integration - Integration by expansion, Differentiation and integration under the sign of integration. [L:05, Q:01]
- Curve tracing, length of curve, area enclosed by curve. [L:05, Q:01]
- Volumes and surface area of solids of revolution. [L:04, Q:01]
- Evaluation of double and triple integrals . [L:05, Q:01]

Group – B: TRIGONOMETRY [L : 20, Q : 05]

- De Moivre's Theorem and its application in expansions. Exponential and trigonometric functions of complex numbers, Properties of exponential and Trigonometric function of a complex number, Euler's theorem, Periodicity, Logarithm of complex quantities. Hyperbolic functions: Relations between hyperbolic and circular function, Relation between inverse Hyperbolic and inverse Circular functions. [L:09, Q:02]
- Gregory's Series, Evaluation of π . [L:03, Q:01]
- Summation of Series. [L:04, Q:01]
- Resolution into Factors. [L:04, Q:01]

REFERENCES :

1. Integral calculus – Das & Mukherjee/ Lalji Prasad/ Gorakh Prasad.
2. Trigonometry – Das & Mukherjee/ Lalji Prasad

***** *Approximate No. of lectures and Questions are given in the right side.*

B.Sc. Part – I (Mathematics Hons.)

Semester – II

PAPER – 3

Marks: 30 **(MSE) + 70 (ESE) = 100** **Time: 3 Hrs.** **Pass Marks: 45**

Instructions **:**

Answer seven questions selecting at least one from each group. Each question contains two parts : Part (a) & Part (b). Part (a) is of short answer type questions (e.g. definition, statement of a theorem and simple questions). It will be of 2 marks. Part (b) is of long answer type questions (e.g. theorems & its proof, problem(s) etc.). It will be of 8 marks.

[About 50% questions should be theoretical]

GROUP-A: REAL ANALYSIS [L : 30, Q : 07]

- Fundamental and Algebraic properties of the set of real numbers, Neighbourhoods and limit points of a set, Completeness property, Archimedean Property and density theorem for the set of real numbers, Bounded sets, open Sets, closed sets and compact sets, supremum & infimum, Bolzano-Weirstras' theorem. Connectedness and Compactness, Heine Borel's theorem. [L:10, Q:02]
- Monotonic sequences, Bounded sequence, Convergence sequence, limit of sequences, limit supremum, limit infimum, Cauchy sequence, General Principle of Convergence, Algebraic operations on convergent sequences and their limits, subsequences. [L:10, Q:02]
- Convergence and divergence of series of real numbers, Pringsheim's theorem, Comparison tests, Cauchy's root test, D Alembert's ratio test, Rabbe's test, De-Morgan's and Bertrand's Test, Logarithmic test, Higher Logarithmic test, Cauchy condensation test, Gauss Ratio Test, Integral Test. Alternating series, Leibnitz Test, Absolutely Convergent Series. [L:10, Q:03]

Group - B : THEORY OF EQUATIONS [L : 20, Q : 05]

- Relation between roots of equations and their co-efficients, symmetric functions. [L:04, Q:01]
- Transformation of equations, Descarte's rule of signs. [L:06, Q:02]
- Cardon's solution of a cubic equation, Discriminant and nature of roots. [L:06, Q:01]
- Descarte's solution of a biquadratic equation. [L:04, Q:01]

REFERENCES:

1. Real Analysis – K. K. Jha / Lalji Prasad/W.Rudin/Royden/ R.R. Goldberg.
2. An introduction to Real Analysis - P.K. Jain & S.K. Kaushik
3. Mathematical Analysis – Shanti Narayan/ Gabriel Klambauer/T.M. Apostol/ S.C. Mallick.
4. Theory of equation – Burnside and Penton/ Lalji Prasad/ M.L. Khanna/ Chandrika Prasad
5. Advance Higher Algebra - Chakravorty & Ghosh
6. Higher Algebra - Hall and Knight/ Bernard & Child

***** *Approximate No. of lectures and Questions are given in the right side.*

B.Sc. Part – I (Mathematics Hons.)

Semester – II

PAPER – 4

Marks: 30 **(MSE) + 70 (ESE) = 100** **Time: 3 Hrs.** **Pass Marks: 45**

Instructions **:**

Answer seven questions selecting at least one from each group. Each question contains two parts : Part (a) & Part (b). Part (a) is of short answer type questions (e.g. definition, statement of a theorem and simple questions). It will be of 2 marks. Part (b) is of long answer type questions(e.g. theorems & its proof, problem(s) etc.). It will be of 8 marks.

[About 50% questions should be theoretical]

Group – A: SET THEORY [L : 20, Q : 05]

- Indexed family of sets, Generalized set operations & De-Morgan's Law, Set mappings. [L:06, Q:01]
- Relation, Equivalence relation, Fundamental Theorem on Equivalence relation, Partial Order Relation, least and greatest elements, lub, glb, maximal, minimal elements. [L:06, Q:02]
- Countable and uncountable sets. [L:03, Q:01]
- Cardinal numbers, algebra of cardinal numbers, Schroeder-Bernstein's Theorem, Cantor's Theorem, Cantor's continuum hypothesis. [L:05, Q:01]

Group – B: ABSTRACT ALGEBRA [L : 30, Q : 07]

- Groups, Preliminary results, Equivalent definitions, subgroups. Cyclic Groups, Group of Permutations Cycles, Symmetric and Alternative Group, Lagrange's Theorem. [L:15, Q:03]
- Normal subgroups, Quotient Groups and Homomorphism, Kernel of a Homomorphism, Centre of group, Invariant subgroup. [L:08, Q:02]
- Fundamental theorem of homomorphism, Isomorphism theorems, Cayley's theorem on group, Conjugate elements, Class Equation. [L:07, Q:02]

REFERENCES:

1. Set theory – K. K. Jha/ S.Singh/ P.R. Halmos
2. Modern Algebra – Surjeet Singh & Quasi Zameeruddin/ K.K. Jha/ A. R. Vasishtha.
3. Advance Higher Algebra – Chakravorty & Ghosh.

***** *Approximate No. of lectures and Questions are given in the right side.*

B.Sc. Part – II (Mathematics Hons.)

Semester – III

PAPER – 5

Marks: 30 **(MSE) + 70 (ESE) = 100** **Time: 3 Hrs.** **Pass Marks: 45**

Instructions **:**

Answer seven questions selecting at least one from each group. Each question contains two parts : Part (a) & Part (b). Part (a) is of short answer type questions (e.g. definition, statement of a theorem and simple questions). It will be of 2 marks. Part (b) is of long answer type questions (e.g. theorems & its proof, problem(s) etc.). It will be of 8 marks.

[About 50% questions should be theoretical]

Group – A : ELEMENTARY NUMBER THEORY [L : 25, Q : 06]

- Divisibility H.C.F., Primes & Unique Factorization. The Diophantine equation ax + by = c, $x^2 + y^2 = z^2$ [L:08, Q:02]
- Residue class, complete and reduced residue systems, congruence's and their properties, Fermat's theorem and Wilson's theorem. [L:08, Q:02]
- Arithmetical functions and mobius inversion formula [L:04, Q:01]
- Algebraic congruence, Solution by inspection, Solution of $ax \equiv b \pmod{}$. Chinese Remainder theorem. [L:05, Q:01]

Group – B : ANALYTIC GEOMETRY OF THREE DIMENSIONS [L : 25, Q : 06]

- Rectangular, Spherical-Polar and Cylindrical coordinates, Direction cosines [L:02, Q:01]
- Equation of planes. [L:07, Q:01]
- Equation of straight lines in different forms, angle between straight lines, shortest distance between straight lines. [L:04, Q:01]
- Sphere [L:04, Q:01]
- Cone [L:04, Q:01]
- Cylinders. [L:04, Q:01]

REFERENCES:

1. Introduction to Number theory – I. Niven/ S.H. Zuckerman and L.H. Montgomery/ Hari Kishan
2. Analytical geometry of three dimension – Shanti Narayan & Mittal/ Jagdish Jha.
3. Elementary Treatise on Coordinate Geometry of Three Dimensions - R.J.T. Bill
4. Analytical Geometry of Three Dimensions - N. Saran & R.S. Gupta.

***** *Approximate No. of lectures and Questions are given in the right side.*

B.Sc. Part – II (Mathematics Hons.)

Semester – III

PAPER – 6

Marks: 30 **(MSE) + 70 (ESE) = 100** **Time: 3 Hrs.** **Pass Marks: 45**

Instructions **:**

Answer seven questions selecting at least one from each group. Each question contains two parts : Part (a) & Part (b). Part (a) is of short answer type questions (e.g. definition, statement of a theorem and simple questions). It will be of 2 marks. Part (b) is of long answer type questions (e.g. theorems & its proof, problem(s) etc.). It will be of 8 marks.

[About 50% questions should be theoretical]

Group – A: ADVANCE ABSTRACT ALGEBRA [L : 25, Q : 06]

- Rings, Preliminary Results, Special kinds, Sub rings and ideals. [L:10, Q:02]
- Quotient ring, Homomorphism and Isomorphism, Fundamental theorem of homomorphism, First and second theorems of isomorphism. [L:07, Q:02]
- Integral domain, field, Field of quotients and embedding theorem, Polynomial rings, Euclidean ring & Unique Factorization in it.

  [L:08, Q:02]

Group – B : COMPLEX ANALYSIS [L : 25, Q : 06]

- Functions of a complex variables: Limits, continuity, derivability, Cauchy- Riemann Equations, Analytic function, Harmonic function, Construction of Analytic function: Milne Thompson method.

  [L:10, Q:03]

- Geometric import of some standard transformation e.g. w = z + c, w = cz, $w=\frac{1}{z}$, $w=e^z$, bilinear transformation $w=\frac{az+b}{cz+d}$. [L:08, Q:02]
- Conformal transformation as transformation effected by analytic function, Special Conformal Transformations $w=z^2$, $w=e^z$, w=sin z. [L:07, Q:01]

REFERENCES:

1. Modern Algebra – Surjeet Singh & Quasi Zameeruddin/ K.K. Jha/A.R. Vasishtha.
2. Complex variable – Churchill/ E. T. Coption/ J.N. Sharma

***** *Approximate No. of lectures and Questions are given in the right side.*

B.Sc. Part – II (Mathematics Hons.)

Semester – IV

PAPER – 7

Marks: 30 **(MSE) + 70 (ESE) = 100** **Time: 3 Hrs.** **Pass Marks: 45**

Instructions **:**

Answer seven questions selecting at least one from each group. Each question contains two parts : Part (a) & Part (b). Part (a) is of short answer type questions (e.g. definition, statement of a theorem and simple questions). It will be of 2 marks. Part (b) is of long answer type questions (e.g. theorems & its proof, problem(s) etc.). It will be of 8 marks.

[About 50% questions should be theoretical]

Group – A: VECTOR ANALYSIS [L : 20, Q : 05]

- Product of three and four vectors.

  [L:04, Q:01]
- Application to geometry & mechanics, work done, moment of a vector about a fixed point and about a line.

  [L:05, Q:01]
- Vector and Scalar point functions and their Geometrical meaning, Differentiation of a vector function of a scalar variable. [L:04, Q:01]
- Gradient, Divergence, Curl and Second order operators in Cartesian coordinate system.

  [L:07, Q:02]

Group – B : MECHANICS [L : 30, Q : 07]

- Conditions for equilibrium of coplanar forces, Astatic Centre. [L:05, Q:01]
- Forces in three dimensions, Wrench, Pitch, Null Lines. [L:05, Q:01]
- Principle of virtual work and its application in two dimensional cases. [L:04, Q:01]
- Common catenary, Stable equilibrium. [L:05, Q:01]
- Kinematics in two dimensions : Tangential, normal, radial, transverse velocities and acceleration, Angular Velocity and Acceleration. [L:03, Q:01]
- Motion of a particle under a central force, Differential equation of a central orbit in both polar and pedal coordinates.

  [L:04,Q:01]
- Newton's law of graviton , planetary orbits , Kepler's laws of motion, Motion of projectile under gravity in a non – resisting medium.

  [L:04, Q:01]

REFERENCES:

***** *Approximate No. of lectures and Questions are given in the right side.*

1. Vector Analysis – Lalji Prasad/ Shanti Narayan/ Murray R. Spiegel
2. Degree mechanics via vector – H. N. Sharma & S. K. Agrawal/ P. Singh & D. K. Sen
3. Statics - S.L. Loney/ Das & Mukherjee/ R.S. Verma
4. Dynamics - A.R. Vasishtha/ Das & Mukherjee/ A.S. Ramsey
5. An Elementary Treatise on the Dynamics of a Particle and of Rigid Bodies - S.L. Loney
6. Mechanics - S.L. Loney

***** *Approximate No. of lectures and Questions are given in the right side.*

B.Sc. Part – II (Mathematics Hons.)

Semester – IV

PAPER – 8

Marks: 30 **(MSE) + 70 (ESE) = 100** **Time: 3 Hrs.** **Pass Marks: 45**

Instructions **:**

Answer seven questions selecting at least one from each group. Each question contains two parts : Part (a) & Part (b). Part (a) is of short answer type questions (e.g. definition, statement of a theorem and simple questions). It will be of 2 marks. Part (b) is of long answer type questions (e.g. theorems & its proof, problem(s) etc.). It will be of 8 marks.

[About 50% questions should be theoretical]

Group – A: ADVANCE REAL ANALYSIS [L : 25, Q : 06]

- Limit and continuity : $\in - \delta$ definition of Limit, Continuity, uniform continuity, Properties of functions, Continuity in closed intervals. Functions of bounded Variation. [L:08, Q:01]
- Derivability: Derivability of a function, Relationship with continuity, Rolle's theorem, Lagrange's and Cauchy theorems, Mean Value Theorem.
  [L:05, Q:02]
- Real functions of two variables, simultaneous and iterated limits: Continuity, partial derivatives, differentiability and related necessary and sufficient conditions.
  [L:04, Q:01]
- Riemann integration: Definition, Darboux theorem I&II, integrability conditions, Particular classes of bounded integrable functions, Primitive, Fundamental theorem, first and second Mean Value theorems, integrability and continuity.
  [L:08, Q:02]

Group – B: DIFFERENTIAL EQUATION [L : 25, Q : 06]

- First order higher degree, Clairaut's form, singular solution, Orthogonal trajectories. [L:06, Q:02]
- Linear equations with constant co-efficient. Homogeneous linear equations with variable co-efficient. [L:08, Q:02]
- Second order linear equations : Solution by changing independent variable and by variation of parameters. [L:06, Q:01]
- Simultaneous equation dx/P = dy/Q = dz/R and Total D.E. Pdx + Qdy + Rdz = 0 together with their geometrical significance. [L:05, Q:01]

REFERENCES :

1. An introduction to Real Analysis - P.K. Jain & S.K. Kaushik
2. Real Analysis – K. K. Jha / Lalji Prasad/ W.Rudin/Royden/ R.R. Goldberg.
3. Mathematical Analysis – Shanti Narayan/ Gabriel Klambauer/T.M. Apostol/ S.C. Mallick.
4. Differential Equation – Piaggio/ Lalji Prasad/ G.F. Simmons
5. Introductory Course on Differential Equations - D.A. Murray
6. Advance Diff. Equation – M.D. Raisinghania

***** *Approximate No. of lectures and Questions are given in the right side.*

B.Sc. Part – III (Mathematics Hons.)

Semester – V

PAPER – 9

Marks: 30 **(MSE) + 70 (ESE) = 100** **Time: 3 Hrs.** **Pass Marks: 45**

Instructions **:**

Answer seven questions selecting at least one from each group. Each question contains two parts : Part (a) & Part (b). Part (a) is short answer type questions (e.g. definition, statement of a theorem and simple and tricky questions). It will be of two marks. Part (b) is of long answer type *questions* (e.g. theorems & its proof, problem(s) etc.). It will be of 8 marks.

[About 50% questions should be theoretical]

Group – A: MATRICES [L : 25, Q : 06]

- Triangular, Singular, non singular, symmetric, skew symmetric matrices, Transpose, Conjugate, Diagonal Matrix, Adjoint of a Matrix, Inverse of a Matrix, Hermitian and Skew Hermitian Matrices, Orthogonal and Unitary Matrices, Partitioning of a Matrix. [L:08, Q:02]
- Elementary transformation, Normal form, elementary matrices, rank of product, equivalence of matrices and criteria for equivalence. Determination of rank of a Matrix. [L:04, Q:01]
- Solution spaces of AX = 0 : Consistency Conditions and the nature of general solutions of AX = B, Rank of sum and product of matrices. [L:05, Q:01]
- Eigen value, Eigen vector of a matrix, Cayley Hamilton Theorem. [L:05, Q:01]
- Similarity Transformation, Diagonalisation, Jordan Canonical Form. [L:03, Q:01]

GROUP B: LINEAR ALGEBRA [L : 25, Q : 06]

- Vector space : Definition and properties; subspaces, linear dependence & independence, dimension and basis of a finite dimensional vector space, Quotient space, Direct sum and complement. [L:09, Q:02]
- Linear transformation : Definition of linear transformation, matrix of linear transformation, row rank and column rank transformation rank - nullity, Sylvester Law of nullity theorem, algebra of linear transformation, Dual spaces. [L:10, Q:02]
- Inner Products and Norm in a Linear Space, properties of inner products, Schwartz inequality, Orthonormal set, Orthonormal basis and Gram - Schmidt Orthogonalisation Process. [L:06, Q:02]

REFERENCES:

1. Modern Algebra – Surjeet Singh & Quasi Zameeruddin/ A.R. Vasishtha
2. A text book of matrices - Shanti Narayan (Relevant Chapters)
3. Matrices - A.R. Vasishtha
4. Linear Algebra - Sharma & Vasishtha.

***** *Approximate No. of lectures and Questions are given in the right side.*

B.Sc. Part – III (Mathematics Hons.)

Semester – V

PAPER – 10

Marks: 30 **(MSE) + 70 (ESE) = 100** **Time: 3 Hrs.** **Pass Marks: 45**

Instructions **:**

Answer seven questions selecting at least one from each group. Each question contains two parts : Part (a) & Part (b). Part (a) is of short answer type questions (e.g. definition, statement of a theorem and simple questions). It will be of 2 marks. Part (b) is of long answer type questions (e.g. theorems & its proof, problem(s) etc.). It will be of 8 marks.

[About 50% questions should be theoretical]

Group – A: ADVANCE INTEGRAL CALCULUS [L : 25, Q : 06]

- Convergence of improper integrals, Comparison Tests, Absolute Convergence, Abel's and Dirichiet's Tests, Definition and convergence of Beta & Gamma Functions and their properties, inter- relation between Beta & Gamma Functions. [L:10, Q:02]
- Multiple integrals via Dirichlet's Theorem, Liouville's extension, change of order of integration and change of variables.

  [L:07, Q:02]
- Vector integration: Line integral, Surface integral, Green's theorem in R^2, Stoke's Theorem, Gauss Divergence theorem. [L:08, Q:02]

Group B: INTEGRAL TRANSFORMS [L : 25, Q : 06]

- Laplace Transform : Definition, Transformation of elementary functions and its properties, Inverse transform, Transform of derivatives and integrals, Multiplication by t, Division by t, Convolution theorem and application to differential equation. [L:13, Q:03]
- Fourier Transform and its properties. [L:12, Q:03]

REFERENCES:

1. Real Analysis - K.K. Jha/ Lalji Prasad/ Mallick & Arora/ Shanti Narayan/ W. Rudin
2. Higher Engineering Mathematics - B.S. Grewal
3. Laplace and Fourier Transform - Goyal, Gupta

***** *Approximate No. of lectures and Questions are given in the right side.*

B.Sc. Part – III (Mathematics Hons.)

Semester – V

PAPER – 11

Marks: 30 **(MSE) + 70 (ESE) = 100** **Time: 3 Hrs.** **Pass Marks: 45**

Instructions **:**

Answer seven questions selecting at least one from each group. Each question contains two parts : Part (a) & Part (b). Part (a) is of short answer type questions (e.g. definition, statement of a theorem and simple questions). It will be of 2 marks. Part (b) is of long answer type questions (e.g. theorems & its proof, problem(s) etc.). It will be of 8 marks.

[About 50% questions should be theoretical]

GROUP - A: LINEAR PROGRAMMING PROBLEM [L : 25, Q : 06]

- Convex sets and their properties. [L:04, Q:01]
- Solution of L.P.P. problem by Simplex method. [L:06, Q:01]
- Big M-method, Two Phase Method. [L:06, Q:01]
- Transportation, Assignment and Sequencing problems, Duality; Dual Simplex method [L:09,Q:03]

GROUP - B: PROBABILITY THEORY & STATISTICS [L : 25, Q : 06]

- Random variable, Concept, Cumulative distributive function, Discrete and continuous random variables. Expectation or mean, variance & moment of a random variable, generating function for moments , Dependent and independent events, conditional and unconditional probability, Baye's theorem. [L:07, Q:02]
- Binomial, Poisson and Normal Distribution [L:06, Q:02]
- Co-efficient of Correlation , Rank, correlation & spearman's formula, Moments, Skewness and Kurtosis [L:06, Q:01]
- Curve fitting and method of least squares, Lines of regression, Regression coefficients and their properties. [L:06, Q:01]

REFERENCES:

1. Linear Programming – R. K. Gupta/ S.D. Sharma
2. Probability – J. Pitman (Narsoa 1993)
3. Probability & Statistics - S.C. Gupta & V.K. Kapoor/ J.N. Kapoor
4. Elementary Statistical Methods - Goongupta & Dasgupta
5. Operation Research - Kantiswaroop.

***** *Approximate No. of lectures and Questions are given in the right side.*

B.Sc. Part – III (Mathematics Hons.)

Semester – V

PAPER – 12

Marks: 30 **(MSE) + 70 (ESE) = 100** **Time: 3 Hrs.** **Pass Marks: 45**

Instructions **:**

Answer seven questions selecting at least one from each group. Each question contains two parts : Part (a) & Part (b). Part (a) is of short answer type questions (e.g. definition, statement of a theorem and simple questions). It will be of 2 marks. Part (b) is of long answer type questions (e.g. theorems & its proof, problem(s) etc.). It will be of 8 marks.

[About 50% questions should be theoretical]

Group A : PARTIAL DIFFERENTIAL EQUATION [L : 25, Q : 06]

- Formation of Partial Differential Equation: Linear P.D.E of Order-One, Lagrange's Method. [L:08,Q:01]
- Non –linear Equation of order One, Four Special Forms & Charpit's Method. [L:06,Q:02]
- Homogeneous linear equations with constant coefficients, Rules for finding C.F. and P.I. [L:06,Q:02]
- Non-linear equations of 2^{nd} order: Monge's Method. [L:05,Q:01]

Group B: FLUID MECHANICS [L : 25, Q : 06]

- Nature and properties of fluid pressure, Pressure of heavy liquids. [L:04, Q:01]
- Equilibrium of fluids under given system of forces. [L:04, Q:01]
- Centre of Pressure. Thrust on Plane and Curved Surfaces. [L:06, Q:01]
- Lagrangian and Eulerian methods, Equation of Continuity. [L:06, Q:02]
- Euler's Equation of motion for perfect fluid, Bernaulli's theorem. [L:05, Q:01]

REFERENCES:

1. Elements of Partial Differential Equations - Ian N. Sneddon.
2. Differential Equation – Piaggio
3. Advance Diff. Equation – M.D. Raisinghania
4. Hydro Statics – J. P. Sinha/ Sanyal & Das/ J.P. Mishra/ P.N. Chatterjee/ Shantiswaroop
5. Hydrodynamics - Ramsey / Shanti Swarup/ Goyal Gupta
6. Fluid Mechanics - M.D. Raisinghania/W.H. Besant & A.S. Ramsey

***** *Approximate No. of lectures and Questions are given in the right side.*

B.Sc. Part – III (Mathematics Hons.)

Semester – VI

PAPER – 13

Marks: 30 **(MSE) + 70 (ESE) = 100** **Time: 3 Hrs.** **Pass Marks: 45**

Instructions **:**

Answer seven questions selecting at least one from each group. Each question contains two parts : Part (a) & Part (b). Part (a) is of short answer type questions (e.g. definition, statement of a theorem and simple questions). It will be of 2 marks. Part (b) is of long answer type questions (e.g. theorems & its proof, problem(s) etc.). It will be of 8 marks.

[About 50% questions should be theoretical]

GROUP - A: SPECIAL FUNCTION [L : 30, Q : 07]

- Series Solution : Ordinary point ; singular point (regular) General methods and forms of series solution (indicial equation –Frobenius Methods) [L: 09, Q:02]
- Legendre function, Solution of Legendre's differential equation, Rodrigue's formula Generating function for $P_n(x)$, Recurrence formula for $P_n(x)$, Orthogonality of Legendre's functions , Equation reducible to Legendre's equation, [L:07, Q:02]
- Bessel 's equation : solution, Recurrence formula for $J_n(x)$ .Generating function for $J_n(x)$, Equation reducible to Bessel 's equation, Orthogonality of Bessel's functions, special cases & integral representation, [L:07, Q:02]
- Hypergeometric functions, Special cases, integral representation, Summation theorem, [L:07, Q:01]

GROUP -B: METRIC SPACE [L : 25, Q : 05]

- Definition and example of metric spaces bounded & unbounded metric space, neighbourhood limits points, closure, interior, exterior & boundary of a set, open sets, Closed sets. [L:13, Q:03]
- Convergence and Completeness in metric space, Bair's theorem, Cantor's Intersection Theorem, Continuity of a function. [L:07, Q:02]

REFERENCES :

1. Special Function - Gupta & Goel.
2. Differential equation – Piaggio
3. Advance Differential Equation – M. D. Raisinghania
4. Metric Space - S.K. Kumaresan (Narsoa)/ J. Sengupta
5. Elements of Topology and Modern Algebra - Simmons/ K.K. Jha.

B.Sc. Part – III (Mathematics Hons.)

***** *Approximate No. of lectures and Questions are given in the right side.*

Semester – VI
PAPER – 14

Marks: 30 **(MSE) + 70 (ESE) = 100** **Time: 3 Hrs.** **Pass Marks: 45**

Instructions **:**
Answer seven questions selecting at least one from each group. Each question contains two parts : Part (a) & Part (b). Part (a) is of short answer type questions (e.g. definition, statement of a theorem and simple questions). It will be of 2 marks. Part (b) is of long answer type questions (e.g. theorems & its proof, problem(s) etc.). It will be of 8 marks.

[About 50% questions should be theoretical]

GROUP- A: NUMERICAL ANALYSIS [L : 25, Q : 06]

- Solution of cubic and biquadratic equations, bisection, Regula Falsi and Newton –Raphson's Method. [L:07, Q:02]
- Operators - Δ & E, Factorial Notation, Ordinary and divided difference, Newton's divided difference formula, Lagrange's interpolation. [L:05, Q:01]
- Numerical differentiation : derivatives, Remainder term. [L:03, Q:01]
- Numerical integration : quadrature formula, Simpson's 1/3 & 3/8 Rule, integration using Newton's interpolation formula. [L:05, Q:01]
- Numerical solution of ordinary differential equation. [L:05, Q:01]

GROUP - B: DISCRETE MATHEMATICS [L : 25, Q : 06]

- Logic : Logical connectives, Negation, Quantifiers, Compound statements, Truth table, Tautologies, Counting principle, Exclusion - inclusion principle, pigeon hole principle. [L:06, Q:02]
- Boolean Algebra and switching circuits. [L:04, Q:01]
- Introduction to Graph Theory : Graph, directed graph, matrices associated with graph and degree sum theorem, Connected Graph Trees, Shortest Path Problem, Kruskd's algorithem, Distrai's algorithem, Bi-partite graph, Eulerian and Hamiltonian graph, Plane graph and Euler's formula, vertex colouring, 5-Colour theorem, Matching and Covering, Marriage theorem. [L:15, Q:03]

REFERENCES:

1. Numerical Mathematical Analysis – Gupta & Mallick/ James B. Scarborough/ Sanyal & Das
2. Higher Engineering Mathematics – B. S. Grewal
3. Discrete Mathematics - K.D. Joshi/ Hari Kishan/ S.R. Pundir
4. Elements of Discrete Mathematics - C.L. Liu

***** *Approximate No. of lectures and Questions are given in the right side.*

B.Sc. Part – III (Mathematics Hons.)

Semester – VI

PAPER – 15

Marks: 30 **(MSE) + 70 (ESE) = 100** **Time: 3 Hrs.** **Pass Marks: 45**

Instructions **:** The distribution of questions (For End Semester) will be as follows :

Group 1 Concept based questions (10 out of 15 questions, each of 2 marks to be solved; word-limit 50 words) **(10 x 2 = 20).**

Group 2 Descriptive type questions (4 out of 6 questions, each of 5 marks to be solved; word-limit 250 words) **(4x5 = 20).**

Group 3 Long answer type questions (3 out of 5 questions, each of 10 marks to be solved) **(3 x 10 = 30).**

The questions should cover the entire syllabus with equal distribution of marks as far as practicable.

- Fundamentals of Computer, Binary System, Octal and Hexadecimal systems. Conversion to and from Decimal systems, Codes, Bits, Bytes and Words. Memory of computer, arithmetic and Logical operations on numbers, Precision. Logic Gates : AND, OR, XOR, NOT and shit/Rotate operators. Algorithms and Flow Charts.

- History and Importance of C, Sample programming, Basic Structure and execution of C programmers, Constants, Variables, and Data Types and various type of declarations, Different type operators and Expressions, Evaluation of Expressions, Operator Precedence and Associability.
- Programming in C : Programmer's model of a computer, Algorithms, Flow Charts, Data Types, Arithmetic and input/output instructions, Decisions control structures, Decision statements. Logical and Conditional operators, Loop Case control structures, Functions Recursions, Preprocessors, Arrays, Puppetting of strings, Structures Pointers, File formatting.

REFERENCES :

1. Computer Fundamentals – B. Ram.
2. Computer Science - J. Glen Brookshear (Addition-Wesley)
3. The C Programming Language – PH 1989 – B. W. Kernigham & D. M. Ritchie
4. Programming in C – V. Rajaranian
5. Let us C - Y. Kanitkar

***** *Approximate No. of lectures and Questions are given in the right side.*

B.Sc. Part – III (Mathematics Hons.)

Semester – VI

PAPER – 16

Marks: 100 **Time: 4 Hrs.** **Pass Marks: 45**

PRACTICALS

IT Tools & "C"

A. IT Tools.

1. MS-Word
2. MS-Excel
3. MS-PowerPoint
4. Internet

B. C Programming Lab.

1. Simple mathematical problems through C programming
   e.g. (i) choosing greater/smaller number
   (ii) finding the roots of quadratic equations etc.

***** *Approximate No. of lectures and Questions are given in the right side.*